

# Air Conditioning, Heating and Refrigeration Technology

The Air Conditioning, Heating and Refrigeration Technology (AHR) curriculum provides the basic knowledge for developing skills fundamental to working with residential and light commercial systems. Graduates can assist in the start-up, preventive maintenance, service, repair, and installation of residential and light commercial systems. A.A.S. graduates also can articulate an understanding of system selection, air balancing, building automation, system applications, and indoor air quality.

Topics include heating, comfort cooling, refrigeration, electricity, and schematic diagrams, along with residential and commercial controls methodologies. Two nationally recognized certificates in Building Automation are available, along with EPA 608 certification, as required by the Environmental Protection Agency for all technicians who handle refrigerants.

Most classes include extensive hands-on exposure and training with industry tools and instruments working on equipment types such as air conditioning, furnaces, heat pumps, mini-splits, and advanced, computer-controlled systems. Safety is integral to all coursework. Students are immersed in discussions around the mechanical and fuel gas codes, residential system sizing, advanced comfort systems, and indoor air quality, among other discipline discussions.

Throughout the program, students are exposed to the Critical Core, an articulated pathway for students to achieve proficiency in Critical Thinking, Communication (Written & Oral), Personal Growth & Cultural Literacy, and Information Technology & Quantitative Literacy. The Critical Core empowers all AHR students to achieve academic, professional, and personal success.

For specific information about potential positions and wages in air conditioning, heating, and refrigeration employment, visit the Central Piedmont Career Coach website.

## Air Conditioning, Heating and Refrigeration Technology (A35100)

### Degree Awarded

An A.A.S. Degree in Air Conditioning, Heating and Refrigeration Technology is awarded by the college upon completion of this program.

### Admissions

- Completion of a high school diploma is required for entering A.A.S. program.
- Many courses have prerequisites or co-requisites; check the Courses section for details.

### Contact Information

The Air Conditioning, Heating and Refrigeration Technology program is in the Skilled Trades Division. For more information, contact the

Program Chair at 704.330.2722, ext. 7431, or the Skilled Trades division at 704.330.4424.

#### General Education Requirements

ENG 111	Writing and Inquiry	3.0
ENG 112	Writing and Research in the Disciplines	3.0
COM 231	Public Speaking	3.0
Take 1 course from the following:		3.0
MAT 110	Mathematical Measurement and Literacy	
MAT 171	Precalculus Algebra	
Select 3 credits of the following:		3.0
ECO 251	Principles of Microeconomics	
ECO 252	Principles of Macroeconomics	
HIS 111	World Civilizations I	
HIS 112	World Civilizations II	
HIS 131	American History I	
HIS 132	American History II	
POL 120	American Government	
PSY 150	General Psychology	
SOC 210	Introduction to Sociology	
Select 3 credits of the following:		3.0
ART 111	Art Appreciation	
ART 114	Art History Survey I	
ART 115	Art History Survey II	
DRA 111	Theatre Appreciation	
HUM 120	Cultural Studies	
HUM 130	Myth in Human Culture	
MUS 110	Music Appreciation	
MUS 112	Introduction to Jazz	
PHI 215	Philosophical Issues	
PHI 240	Introduction to Ethics	
REL 110	World Religions	

#### Major Requirements

ACA 122	College Transfer Success	1.0
AHR 110	Introduction to Refrigeration	5.0
AHR 112	Heating Technology	4.0
AHR 113	Comfort Cooling	4.0
AHR 114	Heat Pump Technology	4.0
AHR 115	Refrigeration Systems	2.0
AHR 211	Residential System Design	3.0
AHR 212	Advanced Comfort Systems	4.0
AHR 213	HVACR Building Code	2.0
AHR 235	Refrigeration Design	3.0
WOL 110	Basic Construction Skills	3.0
ELC 111	Introduction to Electricity	3.0

#### Other Major Requirements

AHR 130	HVAC Controls	3.0
AHR 151	HVAC Duct Systems I	2.0
AHR 160	Refrigerant Certification	1.0
AHR 180	HVACR Customer Relations	1.0
BPR 130	Print Reading-Construction	3.0

#### Technical Electives

Select 2 credits of the following:		2.0
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AHR 215	Commercial HVAC Controls
AHR 255	Indoor Air Quality
AHR 263	Energy Management
WBL 111	Work-Based Learning I
WBL 112	Work-Based Learning I
WLD 112	Basic Welding Processes

**Total Credits** **68**

## Air Conditioning, Heating and Refrigeration Technology - HVAC-R Controls Track (A35100C) Degree Awarded

An A.A.S. Degree in Air Conditioning, Heating and Refrigeration Technology is awarded by the college upon completion of this program.

### Admissions

- Completion of a high school diploma is required for entering A.A.S. program.
- Many courses have prerequisites or co-requisites; check the Courses section for details.

### Contact Information

For more information, call the program office at 704.330.4446 or the Construction Technologies Division at 704.330.4408.

#### General Education Requirements

ENG 111	Writing and Inquiry	3.0
ENG 112	Writing and Research in the Disciplines	3.0
COM 231	Public Speaking	3.0
Select one course from the following:		3.0
MAT 110	Mathematical Measurement and Literacy	
MAT 171	Precalculus Algebra	
Select one course from the following:		3.0
ECO 251	Principles of Microeconomics	
ECO 252	Principles of Macroeconomics	
HIS 111	World Civilizations I	
HIS 112	World Civilizations II	
HIS 131	American History I	
HIS 132	American History II	
POL 120	American Government	
PSY 150	General Psychology	
SOC 210	Introduction to Sociology	
Select one course from the following:		3.0
ART 111	Art Appreciation	
ART 114	Art History Survey I	
ART 115	Art History Survey II	
DRA 111	Theatre Appreciation	
HUM 120	Cultural Studies	
HUM 130	Myth in Human Culture	
MUS 110	Music Appreciation	
MUS 112	Introduction to Jazz	
PHI 215	Philosophical Issues	
PHI 240	Introduction to Ethics	
REL 110	World Religions	

#### Major Core Requirements:

ACA 122	College Transfer Success	1.0
AHR 110	Introduction to Refrigeration (Major Core Requirements)	5.0
AHR 112	Heating Technology	4.0
AHR 113	Comfort Cooling	4.0
AHR 114	Heat Pump Technology	4.0
AHR 211	Residential System Design	3.0
AHR 212	Advanced Comfort Systems	4.0
AHR 213	HVACR Building Code	2.0
ELC 111	Introduction to Electricity (Other Required Coursework)	3.0
AHR 130	HVAC Controls	3.0

#### Other major requirements:

AHR 160	Refrigerant Certification	1.0
AHR 180	HVACR Customer Relations	1.0
AHR 215	Commercial HVAC Controls	2.0
AHR 255	Indoor Air Quality	2.0
AHR 263	Energy Management	2.0
BPR 130	Print Reading-Construction	3.0
WOL 110	Basic Construction Skills	3.0
Select three hours from the following courses:		3.0
ARC 225	Architectural Building Information Modeling I	
ELC 117	Motors and Controls	
ELC 125	Diagrams and Schematics	
ELC 128	Introduction to Programmable Logic Controller	
WBL 110	World of Work	
WBL 111	Work-Based Learning I	
WBL 121	Work-Based Learning II	

**Total Credits** **68**

## No diplomas are offered in Air Conditioning, Heating and Refrigeration Technology.

The specialization certificates listed below can be earned in the Air Conditioning, Heating and Refrigeration (A35100) program.

### Air Conditioning, Heating and Refrigeration Technology Certificate (C35100)

- Air Conditioning, Heating & Refrigeration Technology Certificate Specialization in Refrigeration Systems (C35100-C5 (p. 3))
- Air Conditioning, Heating & Refrigeration Technology Certificate Specialization in Apartment/Rental Maintenance (C35100-C9) (p. 3)
- Air Conditioning, Heating & Refrigeration Technology Certificate Specialization in HVAC-R Industry Introduction (C35100-11) (p. 3)
- Air Conditioning, Heating & Refrigeration Technology Certificate Specialization in Residential Service (C35100-13) (p. 3)
- Air Conditioning, Heating & Refrigeration Technology Certificate Specialization in Indoor Air Quality and Comfort (C35100-14) (p. 3)

- Air Conditioning, Heating & Refrigeration Technology Certificate Specialization in Energy Management & Building Automation (C35100-15) (p. 3)
- Air Conditioning, Heating & Refrigeration Technology Certificate Specialization in Advanced HVAC-R Controls (C35100-16) (p. 3)
- Air Conditioning, Heating & Refrigeration Technology Certificate Specialization in HVAC Installation (C35100-53) (p. 4)

## Requirements

- Completion of a high school diploma or equivalent is encouraged as the foundation of a career in this area.
- Many courses have prerequisites or co-requisites; check the Courses section for details.

## Contact Information

For more information, contact Justin Hoey, Program Chair at 704.330.2722, ext. 7431, or a Student Success Navigator at 704.330.2722 ext. 6100.

### Air Conditioning, Heating & Refrigeration Technology Certificate Specialization in Refrigeration Systems (C35100-C5)

#### Major Requirements

AHR 110	Introduction to Refrigeration	5.0
ELC 111	Introduction to Electricity	3.0
AHR 130	HVAC Controls	3.0
AHR 115	Refrigeration Systems	2.0
AHR 180	HVACR Customer Relations	1.0
AHR 235	Refrigeration Design	3.0
<b>Total Credits</b>		<b>17</b>

### Air Conditioning, Heating & Refrigeration Technology Certificate Specialization in Apartment/Rental Maintenance (C35100-C9)

#### Major Requirements

AHR 110	Introduction to Refrigeration	5.0
AHR 160	Refrigerant Certification	1.0
AHR 180	HVACR Customer Relations	1.0
ELC 113	Residential Wiring	4.0
WOL 110	Basic Construction Skills	3.0
<b>Total Credits</b>		<b>14</b>

### Air Conditioning, Heating and Refrigeration Technology Certificate Specialization in HVAC-R Industry Introduction (C35100-11)

#### Major Requirements

AHR 110	Introduction to Refrigeration	5.0
AHR 160	Refrigerant Certification	1.0
AHR 180	HVACR Customer Relations	1.0
AHR 151	HVAC Duct Systems I	2.0
ELC 111	Introduction to Electricity	3.0
WOL 110	Basic Construction Skills	3.0

BPR 130	Print Reading-Construction	3.0
<b>Total Credits</b>		<b>18</b>

### Air Conditioning, Heating & Refrigeration Technology Certificate Specialization in Residential Service (C35100-13)

#### Major Requirements

AHR 112	Heating Technology	4.0
AHR 113	Comfort Cooling	4.0
AHR 114	Heat Pump Technology	4.0
AHR 130	HVAC Controls	3.0
<b>Total Credits</b>		<b>15</b>

### Air Conditioning, Heating & Refrigeration Technology Certificate Specialization in Indoor Air Quality and Comfort (C35100-14)

#### Major Requirements

AHR 130	HVAC Controls	3.0
AHR 211	Residential System Design	3.0
AHR 212	Advanced Comfort Systems	4.0
AHR 213	HVACR Building Code	2.0
AHR 255	Indoor Air Quality	2.0
AHR 263	Energy Management	2.0
<b>Total Credits</b>		<b>16</b>

### Air Conditioning, Heating & Refrigeration Technology Certificate Specialization in Energy Management & Building Automation (C35100-15)

#### Major Requirements

AHR 130	HVAC Controls	3.0
AHR 211	Residential System Design	3.0
AHR 212	Advanced Comfort Systems	4.0
AHR 213	HVACR Building Code	2.0
AHR 215	Commercial HVAC Controls	2.0
AHR 263	Energy Management	2.0
<b>Total Credits</b>		<b>16</b>

### Air Conditioning, Heating & Refrigeration Technology Certificate Specialization in Advanced HVAC-R Controls (C35100-16)

#### Major Requirements

AHR 130	HVAC Controls	3.0
AHR 215	Commercial HVAC Controls	2.0
AHR 263	Energy Management	2.0
ELC 117	Motors and Controls	4.0
ELC 125	Diagrams and Schematics	2.0
ELC 128	Introduction to Programmable Logic Controller	3.0
<b>Total Credits</b>		<b>16</b>

## Air Conditioning, Heating and Refrigeration Technology Certificate Specialization in HVAC Installation (C35100-53)

AHR 110	Introduction to Refrigeration	5.0
AHR 112	Heating Technology	4.0
AHR 151	HVAC Duct Systems I	2.0
AHR 160	Refrigerant Certification	1.0
AHR 213	HVACR Building Code	2.0
ELC 111	Introduction to Electricity	3.0
WBL 121M	Work-Based Learning II	1.0
<b>Total Credits</b>		<b>18</b>

The following is the suggested plan for when to take each course to complete the Associate in Applied Science degree, based on the program requirements of the 2022-2023 catalog. This is only a recommendation — you may take courses in another order upon consultation with your advisor. This plan is based on you starting with college-level math and English courses, starting your program in the fall, and attending full-time. You can also follow this sequence if you attend part-time. Speak with an advisor about the plan and any questions. This program might also offer diplomas or certificates; visit the catalog or contact the program for details.

Air Conditioning, Heating, and Refrigeration Technology suggested course sequence

Air Conditioning, Heating, and Refrigeration Technology R-Controls suggested course sequence

**AHR 110. Introduction to Refrigeration. 5.0 Credits.** Class-2.0. Clinical-0.0. Lab-6.0. Work-0.0

This course introduces the basic refrigeration process used in mechanical refrigeration and air conditioning systems. Topics include terminology, safety, and identification and function of components; refrigeration cycle; and tools and instrumentation used in mechanical refrigeration systems. Upon completion, students should be able to identify refrigeration systems and components, explain the refrigeration process, and use the tools and instrumentation of the trade.

**AHR 111. HVACR Electricity. 3.0 Credits.** Class-2.0. Clinical-0.0. Lab-2.0. Work-0.0

This course introduces electricity as it applies to HVACR equipment. Emphasis is placed on power sources, interaction of electrical components, wiring of simple circuits, and the use of electrical test equipment. Upon completion, students should be able to demonstrate good wiring practices and the ability to read simple wiring diagrams.

**AHR 112. Heating Technology. 4.0 Credits.** Class-2.0. Clinical-0.0. Lab-4.0. Work-0.0

This course covers the fundamentals of heating including oil, gas, and electric heating systems. Topics include safety, tools and instrumentation, system operating characteristics, installation techniques, efficiency testing, electrical power, and control systems. Upon completion, students should be able to explain the basic oil, gas, and electrical heating systems and describe the major components of a heating system.

**AHR 113. Comfort Cooling. 4.0 Credits.** Class-2.0. Clinical-0.0. Lab-4.0. Work-0.0

This course covers the installation procedures, system operations, and maintenance of residential and light commercial comfort cooling systems. Topics include terminology, component operation, and testing and repair of equipment used to control and produce assured comfort levels. Upon completion, students should be able to use psychrometrics, manufacturer specifications, and test instruments to determine proper system operation.

**AHR 114. Heat Pump Technology. 4.0 Credits.** Class-2.0. Clinical-0.0. Lab-4.0. Work-0.0

This course covers the principles of air source and water source heat pumps. Emphasis is placed on safety, modes of operation, defrost systems, refrigerant charging, and system performance. Upon completion, students should be able to understand and analyze system performance and perform routine service procedures.

Prerequisites: Take One: AHR 110 or AHR 113

**AHR 115. Refrigeration Systems. 2.0 Credits.** Class-1.0. Clinical-0.0. Lab-3.0. Work-0.0

This course introduces refrigeration systems and applications. Topics include defrost methods, safety and operational control, refrigerant piping, refrigerant recovery and charging, and leak testing. Upon completion, students should be able to assist in installing and testing refrigeration systems and perform simple repairs.

Prerequisites: Take AHR 110

**AHR 125. HVACR Electronics. 3.0 Credits.** Class-2.0. Clinical-0.0. Lab-2.0. Work-0.0

This course introduces the common electronic control components in HVACR systems. Emphasis is placed on identifying electronic components and their functions in HVACR systems and motor-driven control circuits. Upon completion, students should be able to identify components, describe control circuitry and functions, and use test instruments to measure electronic circuit values and identify malfunctions.

Prerequisites: Take One: AHR 111, ELC 111, or ELC 112

**AHR 130. HVAC Controls. 3.0 Credits.** Class-2.0. Clinical-0.0. Lab-2.0. Work-0.0

This course covers the types of controls found in residential and commercial comfort systems. Topics include electrical and electronic controls, control schematics and diagrams, test instruments, and analysis and troubleshooting of electrical systems. Upon completion, students should be able to diagnose and repair common residential and commercial comfort system controls. This course covers the types of controls found in residential and commercial comfort systems. Topics include electrical and electronic controls schematics and diagrams, test instruments, and analysis and troubleshooting of electrical systems. Upon completion, students should be able to diagnose and repair common residential and commercial comfort system controls.

Prerequisites: Take One: AHR 111, ELC 111, or ELC 112

**AHR 140. All-Weather Systems. 2.0 Credits.** Class-1.0. Clinical-0.0. Lab-3.0. Work-0.0

This course covers the principles of combination heating and cooling systems including gas-electric, all-electric, and oil-electric systems. Topics include PTAC's and package and split-system units. Upon completion, students should be able to understand systems performance and perform routine maintenance procedures.

Prerequisites: Take One: AHR 112 or AHR 113

**AHR 151. HVAC Duct Systems I. 2.0 Credits.** Class-1.0. Clinical-0.0. Lab-3.0. Work-0.0

This course introduces the techniques used to lay out and fabricate duct work commonly found in HVAC systems. Emphasis is placed on the skills required to fabricate duct work. Upon completion, students should be able to lay out and fabricate simple duct work.

**AHR 160. Refrigerant Certification. 1.0 Credit.** Class-1.0. Clinical-0.0. Lab-0.0. Work-0.0

This course covers the requirements for the EPA certification examinations. Topics include small appliances, high pressure systems, and low pressure systems. Upon completion, students should be able to demonstrate knowledge of refrigerants and be prepared for the EPA certification examinations.

**AHR 180. HVACR Customer Relations. 1.0 Credit.** Class-1.0. Clinical-0.0. Lab-0.0. Work-0.0

This course introduces common business and customer relation practices that may be encountered in HVACR. Topics include business practices, appearance of self and vehicle, ways of handling customer complaints, invoices, telephone communications, and warranties. Upon completion, students should be able to present themselves to customers in a professional manner, understand how the business operates, complete invoices, and handle complaints.

**AHR 211. Residential System Design. 3.0 Credits.** Class-2.0. Clinical-0.0. Lab-2.0. Work-0.0

This course introduces the principles and concepts of conventional residential heating and cooling system design. Topics include heating and cooling load estimating, basic psychrometrics, equipment selection, duct system selection, and system design. Upon completion, students should be able to design a basic residential heating and cooling system.

**AHR 212. Advanced Comfort Systems. 4.0 Credits.** Class-2.0. Clinical-0.0. Lab-6.0. Work-0.0

This course covers water-cooled comfort systems, water-source/geothermal heat pumps, and high efficiency heat pump systems including variable speed drives and controls. Emphasis is placed on the application, installation, and servicing of water-source systems and the mechanical and electronic control components of advanced comfort systems. Upon completion, students should be able to test, analyze, and troubleshoot water-cooled comfort systems, water-source/geothermal heat pumps, and high efficiency heat pumps.

Prerequisites: Take AHR 114

**AHR 213. HVACR Building Code. 2.0 Credits.** Class-1.0. Clinical-0.0. Lab-2.0. Work-0.0

This course covers the North Carolina codes that are applicable to the design and installation of HVACR systems. Topics include current North Carolina codes as applied to HVACR design, service, and installation. Upon completion, students should be able to demonstrate the correct usage of North Carolina codes that apply to specific areas of the HVACR trade.

**AHR 215. Commercial HVAC Controls. 2.0 Credits.** Class-1.0. Clinical-0.0. Lab-3.0. Work-0.0

This course introduces HVAC control systems used in commercial applications. Topics include electric/electronic control systems, pneumatic control systems, DDC temperature sensors, humidity sensors, pressure sensors, wiring, controllers, actuators, and controlled devices. Upon completion, students should be able to verify or correct the performance of common control systems with regard to sequence of operation and safety.

Prerequisites: Take One: AHR 111, ELC 111, or ELC 112

**AHR 225. Commercial System Design. 3.0 Credits.** Class-2.0. Clinical-0.0. Lab-3.0. Work-0.0

This course covers the principles of designing heating and cooling systems for commercial buildings. Emphasis is placed on commercial heat loss/gain calculations, applied psychrometrics, air-flow calculations, air distribution system design, and equipment selection. Upon completion, students should be able to calculate heat loss/gain, design and size air and water distribution systems, and select equipment.

**AHR 235. Refrigeration Design. 3.0 Credits.** Class-2.0. Clinical-0.0. Lab-2.0. Work-0.0

This course covers the principles of commercial refrigeration system operation and design. Topics include walk-in coolers, walk-in freezers, system components, load calculations, equipment selection, defrost systems, refrigerant line sizing, and electric controls. Upon completion, students should be able to design, adjust, and perform routine service procedures on a commercial refrigeration system.

Prerequisites: Take AHR 110

**AHR 240. Hydronic Heating. 2.0 Credits.** Class-1.0. Clinical-0.0. Lab-3.0. Work-0.0

This course covers the accepted procedures for proper design, installation, and balance of hydronic heating systems for residential or commercial buildings. Topics include heating equipment; pump, terminal unit, and accessory selection; piping system selection and design; and pipe sizing and troubleshooting. Upon completion, students should be able to assist with the proper design, installation, and balance of typical hydronic systems.

Prerequisites: Take AHR 112

**AHR 245. Chiller Systems. 2.0 Credits.** Class-1.0. Clinical-0.0. Lab-3.0. Work-0.0

This course introduces the fundamentals of liquid chilling equipment. Topics include characteristics of water, principles of water chilling, the chiller, the refrigerant, water and piping circuits, freeze prevention, purging, and equipment flexibility. Upon completion, students should be able to describe the components, controls, and overall operation of liquid chilling equipment and perform basic maintenance tasks.

Prerequisites: Take AHR 110

**AHR 255. Indoor Air Quality. 2.0 Credits.** Class-1.0. Clinical-0.0. Lab-2.0. Work-0.0

This course introduces the techniques of assessing and maintaining the quality of the indoor environment in residential and commercial structures. Topics include handling and investigating complaints, filter selection, humidity control, testing for sources of carbon monoxide, impact of mechanical ventilation, and building and duct pressures. Upon completion, students should be able to assist in investigating and solving common indoor air quality problems.

**AHR 263. Energy Management. 2.0 Credits.** Class-1.0. Clinical-0.0. Lab-3.0. Work-0.0

This course covers building automation computer programming as currently used in energy management. Topics include night setback, duty cycling, synchronization, schedule optimization, and anticipatory temperature control. Upon completion, students should be able to write programs utilizing the above topics and connect computer systems to HVAC systems.

Prerequisites: Take One: AHR 125 or AHR 215